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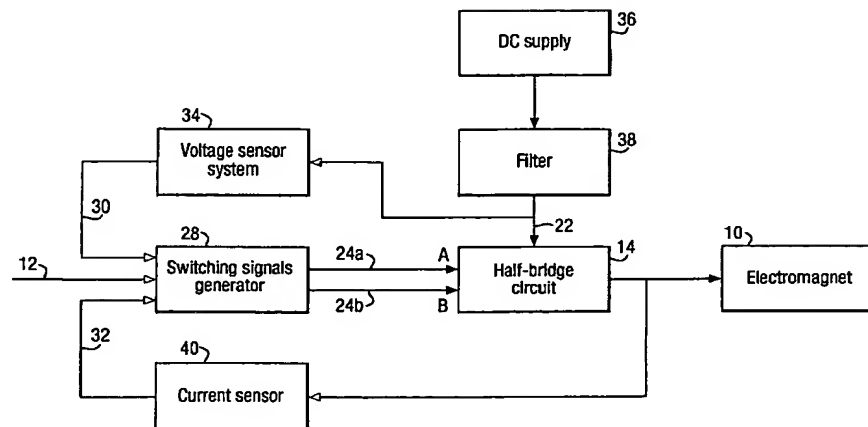
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(54) Title: A SWITCHING CIRCUIT AND A METHOD OF OPERATION THEREOF



(57) Abstract: This invention relates to a switching circuit, such as a bridge circuit, comprising first and second switches operable to produce an electrical signal at the output of the switching circuit at certain voltages. Moreover, this invention also relates to a method of operating such a switching circuit. The switching circuit comprises an input operable to receive a DC signal of +V_s, an output, first and second switches operable in response to first and second switching signals to be switched between on and off states such that switching between various combinations of on and off states produces an electrical signal at the output with voltage pulses at levels of +V_s, 0V and -V_s and a voltage sensor for producing a signal indicative of a voltage offset in the switching circuit. Voltage effects in the switching circuit can be compensated for by using the signal produced by the voltage sensor.

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For two-letter codes and other abbreviations, refer to the "Guidance Notes on Codes and Abbreviations" appearing at the beginning of each regular issue of the PCT Gazette.

INTERNATIONAL SEARCH REPORT

International Application No

PCT/GB 02/05733

A. CLASSIFICATION OF SUBJECT MATTER
IPC 7 H02M3/158

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

IPC 7 H02M

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)

EPO-Internal, WPI Data, PAJ

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	WO 98 39787 A (MANNESMANN REXROTH AG) 11 September 1998 (1998-09-11)	1,2, 5-11,13, 17-22
Y	the whole document	3,4
X	EP 0 150 492 A (ROBERT BOSCH GMBH) 7 August 1985 (1985-08-07)	1,2,5, 7-11,13, 17,19-22
X	WO 00 74222 A (HITACHI) 7 December 2000 (2000-12-07)	1,2,5, 7-11,13, 17,19-22
	abstract figures 4-6	
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☒ Further documents are listed in the continuation of box C.☒ Patent family members are listed in annex.

* Special categories of cited documents :

"A" document defining the general state of the art which is not considered to be of particular relevance

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"P" document published prior to the international filing date but later than the priority date claimed

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"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art.

"&" document member of the same patent family

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INTERNATIONAL SEARCH REPORT

 International Application No
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C.(Continuation) DOCUMENTS CONSIDERED TO BE RELEVANT		
Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	PATENT ABSTRACTS OF JAPAN vol. 018, no. 343 (P-1761), 28 June 1994 (1994-06-28) & JP 06 083402 A (TOSHIBA), 25 March 1994 (1994-03-25) abstract -----	1
A	US 4 768 141 A (GUIDO HUBERTUS ET AL.) 30 August 1988 (1988-08-30) abstract figures 3,4 -----	1
A	DE 40 18 930 A (ROLF-DIETER KLUG) 9 January 1992 (1992-01-09) figures 1,7,8 -----	1
A	US 4 585 986 A (GEORGE R. DYER) 29 April 1986 (1986-04-29) abstract figure 1 -----	6,8-11, 20-22
A	DE 36 38 174 A (PARKER HANNIFIN) 19 May 1988 (1988-05-19) abstract figure 1 -----	6,8-11, 20-22
Y	DE 197 28 318 C (DAIMLER-BENZ AKTIENGESELLSCHAFT) 1 April 1999 (1999-04-01) abstract -----	3,4
A	US 6 194 883 B1 (HIROSHI SHIMAMORI) 27 February 2001 (2001-02-27) abstract figure 4 column 9, line 43 - column 10, line 5 -----	3,4
A	PATENT ABSTRACTS OF JAPAN vol. 1999, no. 08, 30 June 1999 (1999-06-30) & JP 11 069629 A (NISSIN ELECTRIC), 9 March 1999 (1999-03-09) abstract -----	3,4
A	EP 0 443 032 A (KABUSHIKIGAISHA SEKOGIKEN) 28 August 1991 (1991-08-28) abstract figure 1 -----	6

INTERNATIONAL SEARCH REPORT

international application No.
PCT/GB 02/05733

Box I Observations where certain claims were found unsearchable (Continuation of item 1 of first sheet)

This International Search Report has not been established in respect of certain claims under Article 17(2)(a) for the following reasons:

1. ☐ Claims Nos.:
because they relate to subject matter not required to be searched by this Authority, namely:
2. ☒ Claims Nos.: 36 37
because they relate to parts of the International Application that do not comply with the prescribed requirements to such an extent that no meaningful International Search can be carried out, specifically:
Claims 36 & 37: The claims specifies no special technical features to be searched. It is the task of the applicant to identify such special technical features for each claim; it is not the job of the examiner to try to find suitable features in the description.
3. ☐ Claims Nos.:
because they are dependent claims and are not drafted in accordance with the second and third sentences of Rule 6.4(a).

Box II Observations where unity of invention is lacking (Continuation of item 2 of first sheet)

This International Searching Authority found multiple inventions in this International application, as follows:

see additional sheet

1. ☐ As all required additional search fees were timely paid by the applicant, this International Search Report covers all searchable claims.
2. ☐ As all searchable claims could be searched without effort justifying an additional fee, this Authority did not invite payment of any additional fee.
3. ☐ As only some of the required additional search fees were timely paid by the applicant, this International Search Report covers only those claims for which fees were paid, specifically claims Nos.:
4. ☒ No required additional search fees were timely paid by the applicant. Consequently, this International Search Report is restricted to the invention first mentioned in the claims; it is covered by claims Nos.:

1-11, 13, 17-22

Remark on Protest

- ☐ The additional search fees were accompanied by the applicant's protest.
- ☐ No protest accompanied the payment of additional search fees.

FURTHER INFORMATION CONTINUED FROM PCT/ISA/ 210

This International Searching Authority found multiple (groups of) inventions in this international application, as follows:

1. claims: 1-11, 13 17-22

A switch circuit,

with prediction of the value of a DC signal using a finite impulse response filter.

2. claim: 12

A switch circuit,

with a noise shaper for noise-shaping two switch signals.

3. claims: 14-16

A method of operating a switch circuit,

with regulation of the switching signal as a result of variation of a signal representing the input voltage in a feed-forward manner.

4. claims: 23-29

A method of operating a switch circuit,

with first and second switch signals being a sequence of pulses that are not concurrently switched.

5. claims: 30-32

A method of operating a switch circuit,

with calculation of a voltage demand signal that corresponds to a current demand signal.

6. claims: 33-35

A method of operating a switch circuit,

with a computer program being stored on a computer readable medium, and processing means for generating switching signals that results in a desired, average output voltage.

INTERNATIONAL SEARCH REPORT

Information on patent family members

International Application No
PCT/GB 02/05733

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